What is claimed is:

1. An apparatus through at least a portion of which electromagnetic waves are to be propagated, comprising:

a structure, hereinafter referred to as boundary structure, that defines at least an interior, hereinafter referred to as transition interior, said boundary structure including electrically-conductive materials, said boundary structure further defining a first and a second opening to said transition interior, said first opening configured to be open toward an interior, hereinafter referred to as first interior, of a laminated waveguide, hereinafter referred to as first waveguide, and said second opening configured to be open toward an interior, hereinafter referred to as second interior, of a second waveguide, said second interior being defined by an electrically-conductive structure of said second waveguide, whereby an electromagnetic wave is capable of being propagated, for use, via said transition interior, from one of said first interior and said second interior to the other of said first interior and said second interior, wherein content of said first interior has a dielectric constant that differs from a dielectric constant of content of said second interior, and said second waveguide is made not via lamination on a same substrate as said first waveguide.

2. An apparatus as described in claim 1, wherein said second waveguide is a metal waveguide, and said electrically-conductive structure of said second waveguide comprises solid metal walls.

3. An apparatus as described in claim 1, wherein said transition interior and said first interior comprise solid dielectric material, and said second interior comprises air or dielectric material, solid or partial.

4. An apparatus as described in claim 3, wherein said second interior comprises air.

5. An apparatus as described in claim 3, wherein said solid dielectric material of said first interior comprises low-temperature co-fired ceramics (LTCC).

6. An apparatus as described in claim 1, wherein said laminated waveguide and said non-laminated waveguide are configured for propagating electromagnetic waves of at least 10 GHz.

7. An apparatus as described in claim 1, wherein said boundary structure is configured to be capable of being modeled, along with said transition interior, by a model that includes at least two cascaded resonators.

8. An apparatus as described in claim 7, wherein said boundary structure is configured for said boundary structure, together with said transition interior, to include at least two mutually-parallel inter-coupled resonator chains, each of said resonator chains capable of being modeled by a model that includes at least two cascaded resonators.

9. An apparatus as described in claim 7, wherein said boundary structure is configured to provide a return loss profile that includes at least two reflection zeroes.

10. An apparatus as described in claim 7, wherein said boundary structure is configured to provide a bandwidth of at least 2.5 GHz, with a return loss below -15 dB within said bandwidth, for transitioning an electromagnetic wave of at least 10 GHz from said one of said first interior and said second interior to the other of said first interior and said second interior.

11. An apparatus as described in claim 1, wherein said second opening has a same shape and size as a cross section of said second waveguide.

12. An apparatus as described in claim 1, wherein said boundary structure, when considered in a particular orientation, comprises an upper electrically-conductive

layer and a lower electrically-conductive layer connected by one or more electrically-conductive walls.

13. An apparatus as described in claim 12, wherein said electrically-conductive walls are not continuous sheets of electrically-conductive material but instead, when considered from said particular orientation, each comprise horizontal layers of electrically-conductive material, said horizontal layers having dielectric materials between them, said horizontal layers being connected inter-layer by via-holes filled with electrically-conductive material.

14. An apparatus as described in claim 12, wherein, when considered from said particular orientation, said second opening is an opening in one of said electrically-conductive layers, said second opening being enclosed, in a floor-plan view in said particular orientation, by said electrically-conductive walls and by said first opening.

15. An apparatus as described in claim 12, wherein, when considered from said particular orientation, said second opening is an opening in said lower electrically-conductive layer, said second opening being enclosed, in a floor-plan view in said particular orientation, by said electrically-conductive walls and by said first opening.

16. An apparatus as described in claim 15, further comprising at least an electrically-conductive wall, hereinafter referred to as partition wall, that helps define two inter-coupled resonator chains.

17. An apparatus as described in claim 16, wherein, when considered from said particular orientation, said partition wall overlies said second opening.

18. An apparatus as described in claim 17, wherein, when considered from said particular orientation, said partition wall defines a cut-out at its bottom, over said second opening, that helps to improve matching condition to second waveguide.

19. An apparatus as described in claim 1, wherein said apparatus is used in an integrated antenna array.

20. An apparatus as described in claim 19, wherein said apparatus further comprises said integrated antenna array, of which said boundary structure and transition interior are parts.

21. An apparatus as described in claim 18, wherein said apparatus further comprises a collision-avoidance radar system, of which said integrated antenna array is a part.

22. An apparatus as described in claim 1, wherein said second waveguide has a cross section of either rectangular shape or circular shape.

23. An apparatus as described in claim 1, further comprising packaging, wherein said apparatus is hermetically sealed.

24. An apparatus as described in claim 1, further comprising said laminated waveguide, wherein said boundary structure is integrally fabricated on a same substrate as said laminated waveguide.

25. An apparatus as described in claim 24, further comprising a transition from said laminated waveguide to a transmission line other than said second waveguide, said transmission line not being a metal waveguide that defines an interior and not being a laminated waveguide.

26. An apparatus as described in claim 25, wherein said transmission line is a microstrip line or a stripline, said apparatus further comprising at least one processing circuit connected to said microstrip line or stripline.

27. An apparatus as described in claim 26, further comprising a monolithic microwave integrated circuit (MMIC), coupled to said microstrip line or striplien.

28. An apparatus as described in claim 25, further comprising a diplexer coupled to said laminated waveguide.

29. An apparatus as described in claim 1, wherein said dielectric constants differ from one another by at least three.

30. A method for transitioning electromagnetic waves from a first waveguide to a second waveguide, relevant to the apparatus as described in claim 1, the method comprising:

accepting an electromagnetic wave, from said one of said first interior and said second interior, into said transition interior; and

conveying said electromagnetic wave from said transition interior into said other of said first interior and said second interior.

31. A method for transitioning electromagnetic waves from a first waveguide to a second waveguide, said first waveguide having a first interior defined by an electrically-conductive first structure, said second waveguide having a second interior defined by an electrically-conductive second structure, content of said first and second interiors having mutually-different finite dielectric constants, the method comprising:

accepting an electromagnetic wave directly from said first interior into an interior, hereinafter referred to as transition interior, of a transition, said transition interior being defined by an electrically-conductive structure of said transition, said transition interior being open to said first and second interiors; and

conveying said electromagnetic wave directly from said transition interior into said second interior.

32. A method as described in claim 31, wherein said transition is configured to be capable of being modeled by a model that includes at least two cascaded resonators.

33. A method as described in claim 32, wherein said transition is configured for said transition interior to include a portion having at least two branches, at least a first branch of said two branches capable of being modeled by a model that includes at least two cascaded resonators.

34. A method as described in claim 31, wherein said conveying step comprises degrading signal quality of said electromagnetic wave according to a reflection loss profile of said transition, wherein said reflection loss profile includes at least two reflection zeroes.

35. A method as described in claim 34, wherein said electromagnetic wave is of at least 10 GHz, and said reflection loss profile provides a bandwidth of at least 2.5 GHz over which return loss is below -15 dB for said electromagnetic wave.

36. A method as described in claim 31, wherein said electromagnetic wave is of at least 10 GHz.

37. A method for producing a waveguide-to-waveguide transition, the method comprising:

fabricating an electrically-conductive structure, hereinafter referred to as transition boundary structure, said transition boundary structure to define an interior, hereinafter referred to as transition interior, including a first and a second opening to said transition interior, wherein, at least after said transition is deployed for use, said first opening is to open toward a first interior of a first waveguide and said second opening is to open toward a second interior of a second waveguide, said first and second interiors to comprise mutually-different materials having mutually-different finite dielectric constants.

38. A method as described in claim 37, further comprising joining said electrically-conductive structure with an electrically-conductive structure of said first waveguide whereby said first opening opens to said first interior.

39. A method as described in claim 37, wherein said fabricating step comprises:

fabricating a first layer that includes an electrically-conductive material;

fabricating a second layer that includes an electrically-conductive material;

fabricating walls that include an electrically-conductive material, said walls to join said first and second layers, said transition boundary structure comprising said first and second layers and said walls.

40. A method as described in claim 39, wherein:

said step of fabricating said walls comprises laminating multiple layers of electrically-conductive material, there being dielectric material between portions of said multiple layers of electrically-conductive material, said multiple layers of electrically-conductive material joined by via holes filled with electrically-conductive material, wherein electromagnetic waves to be handled by said transition would be prevented from escaping through said walls.

41. A method as described in claim 40, wherein said step of fabricating said transition boundary structure comprises fabricating said transition boundary structure on a same substrate as said first waveguide, and said first waveguide is a laminated waveguide.

42. A method as described in claim 37, wherein said first waveguide is a laminated waveguide, and said second waveguide is a metal waveguide.